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Electricity Policy Research Group

Electricity Liberalisation in the European Union: A Progress Report

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Abstract

It is around 5 years since my colleague, Tooraj Jamasb, and I reviewed the EU's progress with electricity reform (Jamasb and Pollitt, 2005). At that time many countries were still struggling to implement elements of the EU wide policy on electricity sector liberalisation that they had signed up to. In this short update paper we review the latest evidence on progress with electricity liberalisation in the EU. We begin with a short review of the legislative background. We continue with a look at the evolution of markets and trading in electricity across the EU. Next we outline progress with the key reform elements and their impact on market structure issues within the EU. We look at the performance of the whole sector and company level performance. We proceed to discuss progress in reducing emissions and promoting renewables. In closing we note recent developments in electricity reform.

Keywords Single European Electricity Market, Electricity Directive

JEL Classification L11, L22, L 52, Q48

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Electricity Liberalisation in the European Union: A Progress Report

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It is around 5 years since my colleague, Tooraj Jamasb, and I reviewed the EU's progress with electricity reform (Jamasb and Pollitt, 2005). At that time many countries were still struggling to implement elements of the EU wide policy on electricity sector liberalisation that they had signed up to. Five years on, it is a good time to revisit the issue of how successful this wide ranging set of policies have been and to assess prospects going forward.

The electricity sector over the last five years has assumed a higher public profile for a number of reasons. First, its leadership role in the decarbonisation of the economy has been highlighted following climate change concerns. Second, the resurgence of the issue of energy security on the back of rising oil and gas prices and the perceived gas security threat to the EU from Russia has called into question the growing reliance of electricity on gas-fired generation plants. Third, there has been increased public consciousness of the cost of energy following significant rises in consumer prices. Fourth, the credit crunch has further raised concerns about the ability of the market to deliver the large quantities of investment which are predicted as being necessary to decarbonise the sector and to meet energy security concerns.

EU electricity (and gas) liberalisation remains a formidable energy reform programme, unmatched in scale and depth in any other major region of the world. While other regions of the world have seen major pauses to their energy market reforms (most notably in the United States), the EU in the form of the European Commission, continues to press ahead. DG TREN has recently secured the passage of a 'Third Package' of energy market reforms, extending earlier reform packages in 1996 and 2003. Meanwhile DG Competition continues to provide significant support for the progress towards the creation of a single European energy market via vigorous pursuit of competition law enforcement in the area of electricity and gas, most notably via its Energy Market Inquiry. While individual governments demonstrate increasing ambivalence to the EU single energy market project, it continues to have significant central momentum.

In this short update paper I want to review the latest evidence on progress with electricity liberalisation in the EU. I begin with a short review of the legislative background in Section 1. Section 2 looks at the evolution of markets and trading in electricity across the EU. Section 3 outlines progress with the key reform elements. Section 4 examines market structure issues within the EU. Section 5 looks at the performance of the whole sector in recent years. Section 6 reviews company

[1] I was asked to write this article in celebration of the 10 year anniversary of the Italian Law and Economics journal, *Mercato Concorrenza Regole.* I would particularly like to thank the journal for the encouragement to return to a subject very much in line with both its and my own interests. The author particularly wishes to thank Pippo Ranci and participants at the 10 year anniversary conference of *Mercato Concorrenza Regole* held at FEEM for their help and encouragement. Alessandra Motz provided excellent research assistance. The author acknowledges the financial support of FEEM and of the ESRC Electricity Policy Research Group. An anonymous referee provided excellent comments. The usual disclaimer applies.

level performance. Section 7 discusses progress in reducing emissions and promoting renewables. Section 8 notes recent developments in electricity reform and Section 9 concludes.

Section 1: The Legislative Background

There have now been three substantive electricity directives (1996, 2003 and 2009) which have set out electricity reform policy across the EU (and been significant in setting policy in Norway and Switzerland). The most significant so far, in terms of driving policy to date, remains Directive 03/54/EC. This laid out the path of reform in member states to December 2007. This Directive required the establishment of an independent regulatory agency for electricity in each member state. It strengthened the requirements for unbundling of transmission and distribution system operation from retail and generation activities and required free entry into the electricity generation market, thus strengthening the operation of a competitive wholesale market. It required market opening to competition of the whole electricity market, including for residential consumers. The Directive envisaged significant progress towards the completion of a single market in electricity services across the EU. We will discuss the third legislative package, enacted in July 2009, later in the paper.

The theoretical basis of EU electricity reforms remains the theory of competitive markets. Thus the aim of European Commission is to increase the numbers of competing generation and retailing firms in each national market and to reduce the effective market shares of former monopoly incumbents. This involves reducing barriers to energy in both generation and retailing and increasing the effective size of the market from the national level to the whole of the EU, via the creation of regional markets made up of more than one country. There has also been an emphasis on incentive based regulation of natural monopoly transmission and distribution electricity networks, carried out by an independent regulator.

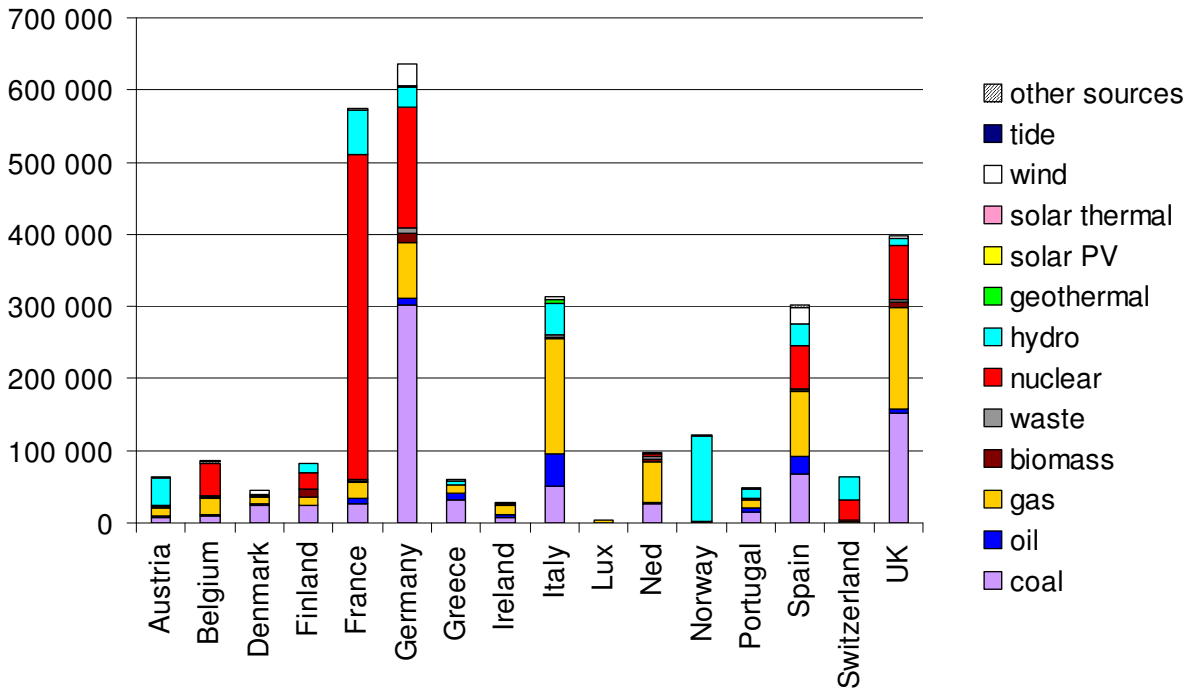
The empirical basis for competitive EU electricity markets can draw on diverse experiences from around the world, including within the EU. The EU's emphasis on vertical unbundling of networks from generation and retailing is based on the anti-competitive effects of continuing vertical integration (e.g. in relatively successful markets such as Chile, see Pollitt, 2004). Independent regulation has demonstrated its value in controlling the behaviour of incumbent monopoly networks (e.g. via the observation of what happens in the absence of incentive regulation, e.g. in New Zealand in the 1990s, see Bertram and Twaddle, 2006). Collusion (or gaming) remains a potential problem in markets where there is a lack of effective competition (e.g. in California, see Joskow, 2001). Entry barriers are a significant issue in some national markets (e.g. in France or Germany, see European Commission, 2007). Security of supply can be an issue where there is a lack of effective co-ordination across jurisdictions (e.g. the electricity blackouts in New York and Italy in 2003, see Bailek, 2004). These negative experiences suggest the value of vertical unbundling, independent regulation, wholesale and retail market competition, reduced barriers to entry and improved international co-ordination: all of which have been strongly championed by the European Commission in the electricity sector.

Section 2: EU Electricity markets and trading

National electricity markets within the EU are extremely diverse in terms of size and mix of electricity generation, some examples are given in Figure 1. France depends heavily on nuclear

power, coal is significant in Germany, hydro is dominant in Norway and gas is relatively important in Italy and the UK. National markets vary in size from tiny (Luxembourg) to very large (Germany).

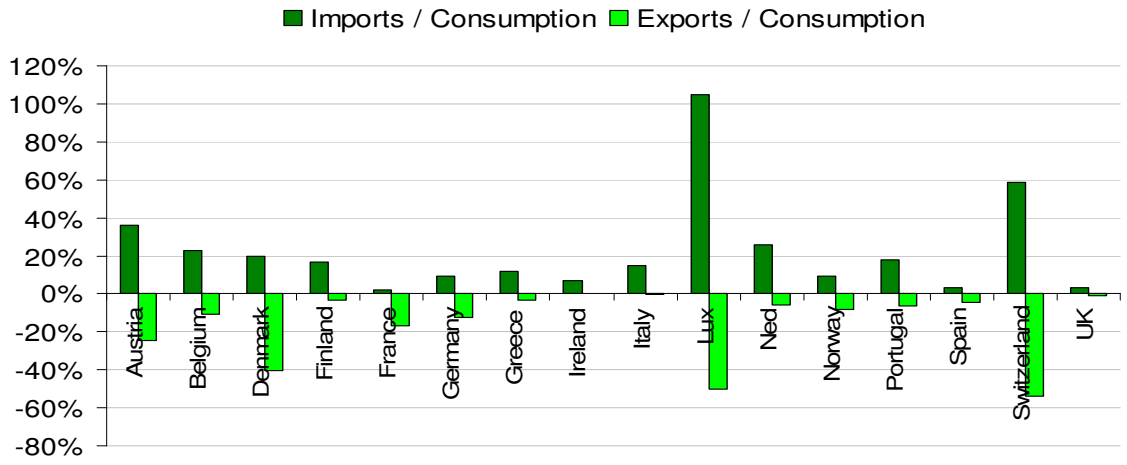
Figure 1: National Electricity Supply by Source (GWh) in 2006



Source: IEA Energy Statistics 2008

Similarly, there is a wide variation in the degree of openness to international trade in electricity, as shown in Figure 2. Here we can see that trade remains small as a percentage of national consumption for most countries, though France, Germany and Italy are absolutely large in terms of their volumes of exports (and/or imports). Countries such as Austria, Denmark, Luxembourg and Switzerland have significant, in relation to national consumption, transit flows of electricity.

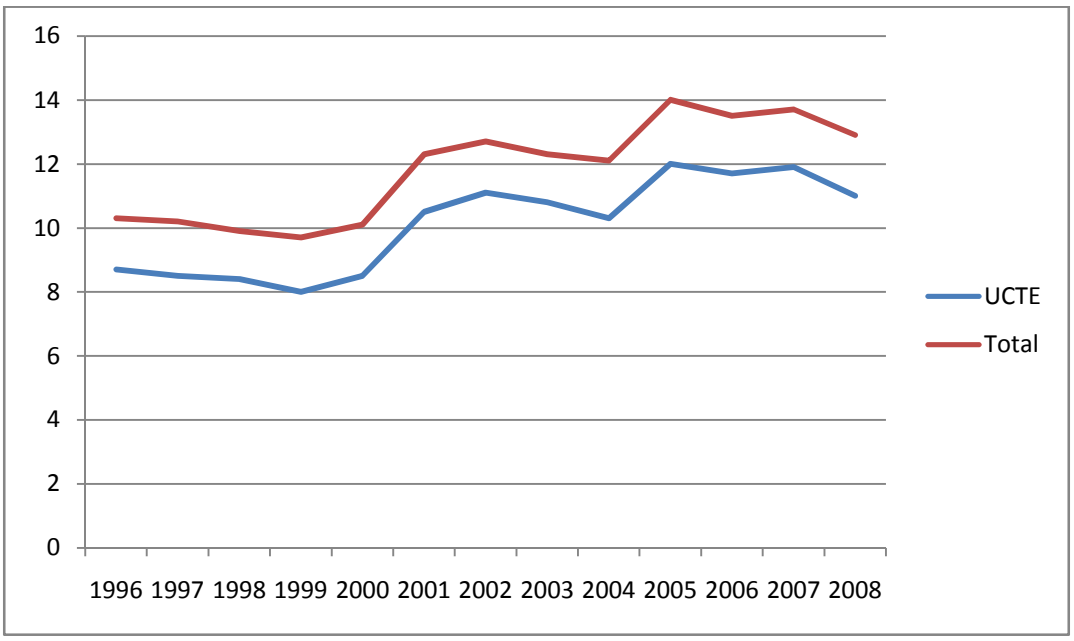
Figure 2: Imports and Exports of Electricity as % of national consumption (2006)



Source: IEA Energy Statistics 2008

Although electricity trade remains low relative to trade more generally, Figure 3 shows that electricity trade as a percentage of consumption has been increasing since 1998. The figure looks at countries that are part of the UCTE synchronised system and therefore covers most of western Europe (the figure shows within UCTE trade and all trade including UCTE trade with non-UCTE countries). The trend rise reflects the fact that the differences in national endowments of electricity generation capacity and in national patterns of demand should give rise to significant trading opportunities as liberalisation progresses.

Figure 3: Cross Border Electricity Exchanges as a % of total consumption (UCTE system)



Source: UCTE Statistical Yearbook 2008, p.138.[2]

Although the European Commission's policy is aimed at creating a single European electricity market, what has emerged is a set of regional electricity markets (see Eurelectric, 2004). The oldest of these is Nord Pool which pre-existed the recent electricity directives, but did add Denmark in 1998. Germany and Austria were linked via the EEX in 2002. An Iberian market of Portugal and Spain was created via Omel in 2004. France, Belgium and Netherlands formed Belpex in 2006. A market covering France, Belgium, Netherlands, Germany and Austria seems likely to emerge soon. Ireland and UK will form a single market once a planned interconnector is built between them. Progress is being made on a South East European electricity market which would involve Romania, Bulgaria and Greece as well as Albania, Slovenia, Croatia, Bosnia, Montenegro and Serbia (see Pollitt, 2009).

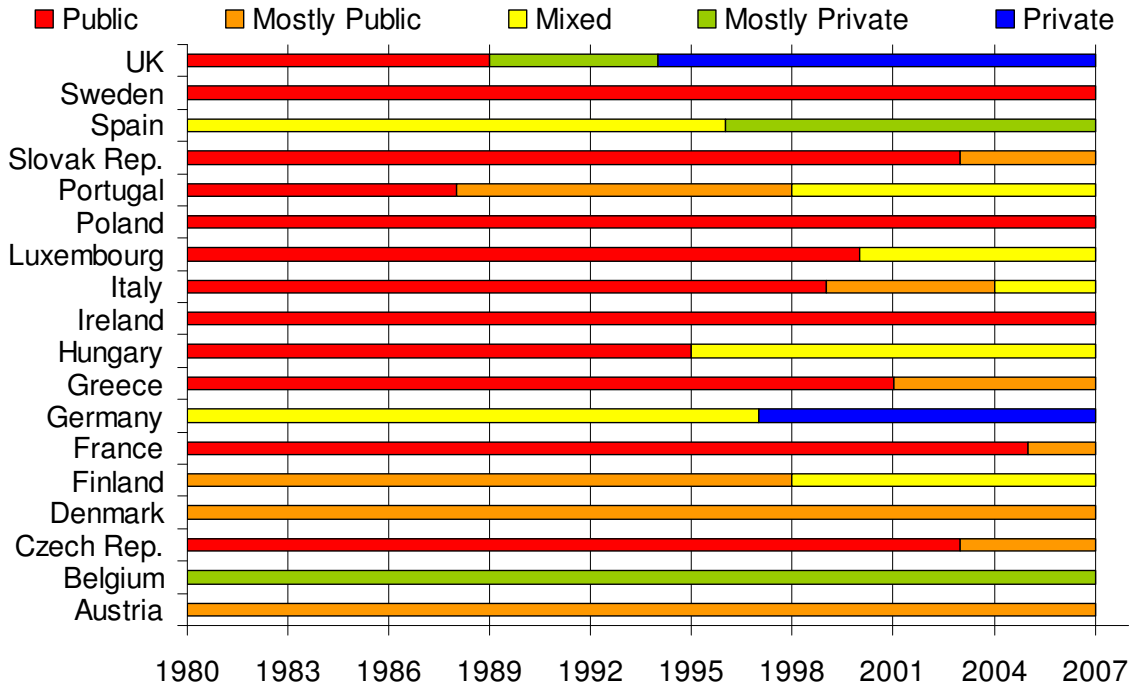
Section 3: Key reform steps

Electricity reform can generally be thought of as having four main elements: privatisation of publicly owned electricity assets; the opening of the market to competition; the extension of vertical unbundling of transmission and distribution from the generation and retailing; and the introduction of an independent regulator. These steps are inter-related. EU reforms have focussed on the last

[2] There is an increase in the number of countries participating in 2001 and 2003.

three elements and have not explicitly addressed the issue of privatisation. However the pressure to unbundle and to introduce competition necessarily introduces non-nationally publicly owned electricity companies as competitors or as new asset owners, thus undermining the rationale for continuing state ownership of former monopolies. Figure 4 illustrates the progress with privatisation in some EU countries. It illustrates a strong move away from full public ownership towards more private involvement, but also how few countries in the EU have full private ownership of electricity assets.

Figure 4: Electricity Privatisation Timeline by Country



Source: OECD international regulation database, 2009

In terms of market opening to competition the 2003 Directive mandated full retail market opening by the end of 2007. Table 1 illustrates the fact while most countries did technically meet the deadline, very few were compliant with it in 2006. This suggests significant amounts of nominal market opening for residential customers by 2007. However as Jamasb and Pollitt (2005) pointed out, given the starting point in 1996, this represents a very significant forcing effect of EU Electricity Directives.

Table 2 illustrates the extent of network unbundling in 2008. The table shows that while most countries had adopted the European Commission's preferred approach of ownership unbundling of the transmission system operator (TSO), both Germany and France had not done so. The table also shows that public ownership is very significant in transmission for many countries, indicating a reluctance on the part of governments to relinquish control of this central part of their national electricity system. Table 2 also shows the wide diversity of scales in distribution companies (DSOs) and that many of these remain legally integrated with retailing (as is allowed if they have less than 100,000 customers).

Table 3 illustrates the progress countries have made with introducing an independent national electricity regulator. Here, following Jamasb and Pollitt (2005), we score the regulatory agency according to five characteristics which are indicative of its independence from central government.

A score of 5 indicates the highest level of independence. We find that of the countries we examined in 2005 only Germany shows a marked improvement in its score, having belatedly created an independent regulator for electricity in mid-2005. Somewhat surprisingly, only 5 countries examined have the top score, indicating a significant lack of autonomy on the part of 'independent' regulatory agencies.

Finally, it is interesting to put electricity reforms in the context of utility sector reforms more generally across the EU. Wolfl et al. (2009, p.26) compare 9 industries (including electricity, gas, rail and telecoms) in terms of liberalisation score (0 being the most liberalised and 6 most restrictive). It is interesting to observe that electricity now has a reasonably low average score (1.9), but the highest variance (+/- 0.8), indicating the wide variation in degree of liberalisation across EU countries. By contrast telecoms, generally recognised to be the leading liberalised utility sector, has a lower average score (1.3) and virtually no national variance (+/-0.2).

Table 1: Proportion of the retail electricity market open to competition (%)

	2006	2007
Austria	100	100
Belgium	87.4	100
Bulgaria	60	100
Cyprus	30.8	31.8
Czech Republic	100	100
Denmark	100	100
Estonia	13	12
Finland	100	100
France	69	100
Germany	100	100
Greece	70	90.1
Hungary	37.09	22.29
Ireland	100	100
Italy	73	100
Latvia	76	100
Lithuania	74	74
Luxembourg	84	100
Netherlands	100	100
Poland	80	100
Portugal	100	100
Slovakia	80	100
Slovenia	75	100
Spain	100	100
Sweden	100	100
United Kingdom	100	100

Source: EC Benchmarking Report (2009)

Table 2: Extent of network unbundling across the EU

	Ownership unbundling of the TSO	Public ownership	Private ownership	Nr. DSOs	% DSOs legally unbundled	Application of 100,000 customers exemption	% DSOs with less than 100,000 customers
Austria	No	51	49	130	8%	Yes	92%
Belgium	No	35.55	64.45	26	100%	No	54%
Bulgaria	No	100	0	4	100%	No	25%
Cyprus	No	100	0	1	0%	Yes	0%
Czech Rep.	Yes	100	0	280	1%	Yes	81%
Denmark	Yes	100	0	101	100%	No	95%
Estonia	No	100	0	40	3%	Yes	98%
Finland	Yes	12	88	89	56%	No	93%
France	No	84.8	15.2	148	0%	Yes	97%
Germany	No	0	100	855	18%	Yes	91%
Greece	No	51	49	1	0%	No	0%
Hungary	Yes	0.1	99.9	6	100%	No	0%
Ireland	Yes	100	0	1	0%	No	0%
Italy	Yes	30	70	163	*	Yes	93%
Latvia	No	0	100	10	10%	Yes	90%
Lithuania	Yes	96.6	3.4	7	29%	Yes	71%
Lux.	No	32.8	67.2	9	22%	Yes	89%
NL	Yes	100	0	8	100%	No	63%
Poland	Yes	100	0	18	78%	Yes	22%
Portugal	Yes	51	49	13	85%	Yes	77%
Romania	Yes	100	0	30	23%	Yes	73%
Slovakia	Yes	100	0	154	2%	Yes	98%
Slovenia	Yes	100	0	1	100%	No	0%
Spain	Yes	20	80	329	100%	Yes	98%
Sweden	Yes	100	0	175	100%	No	90%
UK	Yes	0	100	18	100%	No	22%

Source: EC Benchmarking Report (2009)

*Obligation of legal unbundling for companies serving more than 100,000 clients in force since th 1st January 2008

Table 3: Powers of the Electricity Sector Regulatory Agency

	Score /5
Germany	3
Denmark	3
Greece	3
Netherlands	3
Spain	3
Luxembourg	3.5
Finland	4
France	4
Sweden	4
Austria	4.5
Italy	4.5
Belgium	5
Ireland	5
Portugal	5
UK	5
Norway	5

Scoring: *Type of regulation*, Ex Ante=1, Ex Post=0; *Network Access conditions* set by regulator =1, Other=0; *Dispute Settlement* by regulator=1, Other=0; *Ministry involvement*, No=1, General only=0.5, Yes=0; *Information powers*, strong =1, Other=0.

Source: Derived from EC 3rd Benchmarking Report (2004), updated.

Section 4: Market Structure

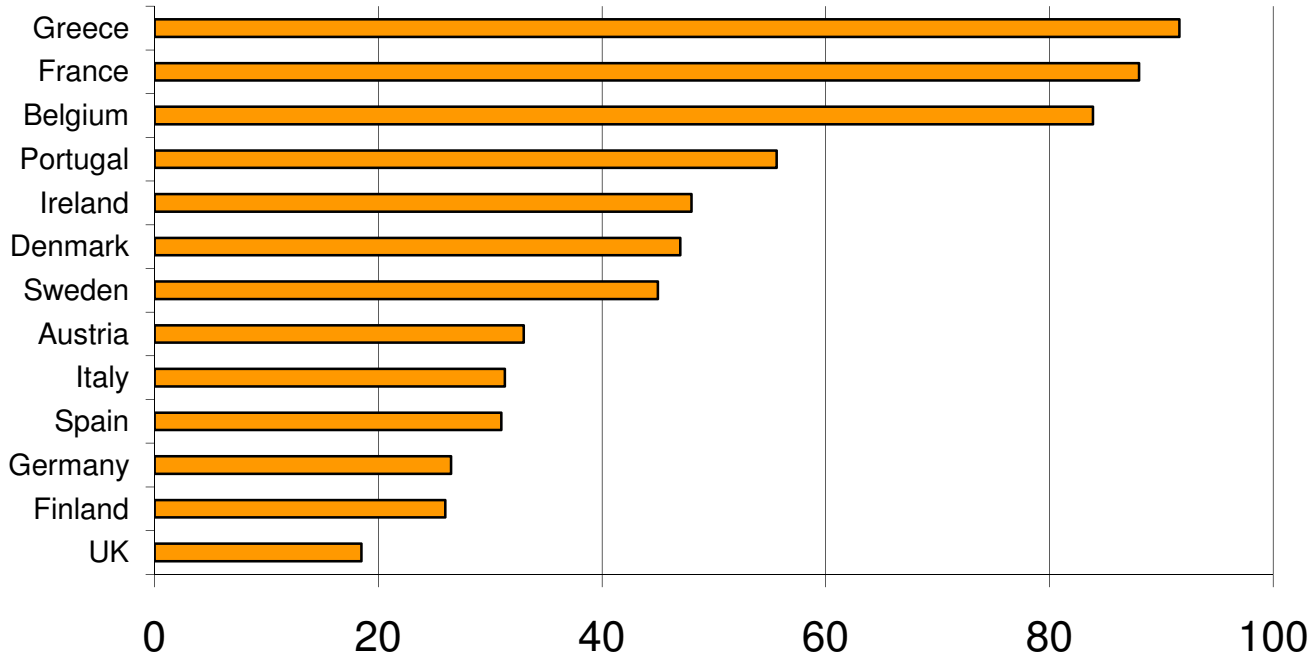
The need to create a properly functioning EU wide or regional electricity market is well illustrated by a look at the market structure of national electricity markets in Europe for both wholesale generation and retail. Somewhat surprisingly, the EU does not collect data on the degree of concentration of the whole EU market or on its various regional electricity markets. Figure 5 shows the continuing dominance of former monopoly generators in national wholesale markets. Market shares of above 20% for the largest generator might be considered a cause for concern. Of the major national electricity markets only the UK has a largest generator with less than 20% market share, while in France the market share of EdF is above 80%. While dominance is not the same as 'abuse of dominance' under competition law, what this data suggests is that - in the absence of significant break-ups - significant international competition, via international transmission interconnectors, is required if former incumbent generators are to face effective competition within their national markets.

The question of whether the current wholesale market situation is anti-competitive has been examined closely by the European Commission's Energy Sector Inquiry. A major focus of their investigation was on the efficient use and building of interconnector capacity and the Inquiry concluded there were competition issues surrounding a lack of international interconnector capacity (European Commission, 2007).Table 4 suggests that in many national markets effective international competition is likely to be hampered by significant congestion on most of the largest interconnectors between countries with significant incumbent market shares, with some interconnectors congested almost all of the time.

In national retail markets the picture of patchy competition is similar. Here a competitive retail market might require, as a minimum, the top three retailers to have combined market shares of less than 60%. Figure 6 shows that in many EU countries the market share of the largest three retailers is significantly more than 80%. These figures may underplay the problem given that that the market share of the largest retailer may be much greater than one third of the total market share of the top three. Given that retail markets are inevitably more local than wholesale markets, it is quite clear that healthy competition would require actual market share loss at the national level by incumbents, to a greater extent than might be the case in wholesale markets. It is difficult to avoid the conclusions that most residential retail markets are some way short of being competitive.

Healthy national retail competition might be indicated by active consumer switching. The evidence on consumer switching is somewhat patchy as shown in Table 5. In 2007 of the reported countries only Sweden seems to have had a very active household market with switching rates above 10%. Many others have switching rates of 0%. Only Sweden had higher switching rates for small industry and households higher than for medium sized industry. By contrast the UK had a switching rate of 19.1% for small industry and households in 2007 (EU Benchmarking Report, 2009, Technical Annex, p.7). Low switching rates do not necessarily indicate that consumers are being exploited. They may however indicate that household tariffs continue to be subject to some form of price control, which coincidently reduces the attractiveness of the small customer market to non-incumbents (as in France and Belgium).

Figure 5: Market Share (%) of the Largest Generator (2008)



Source: Eurostat and own calculations

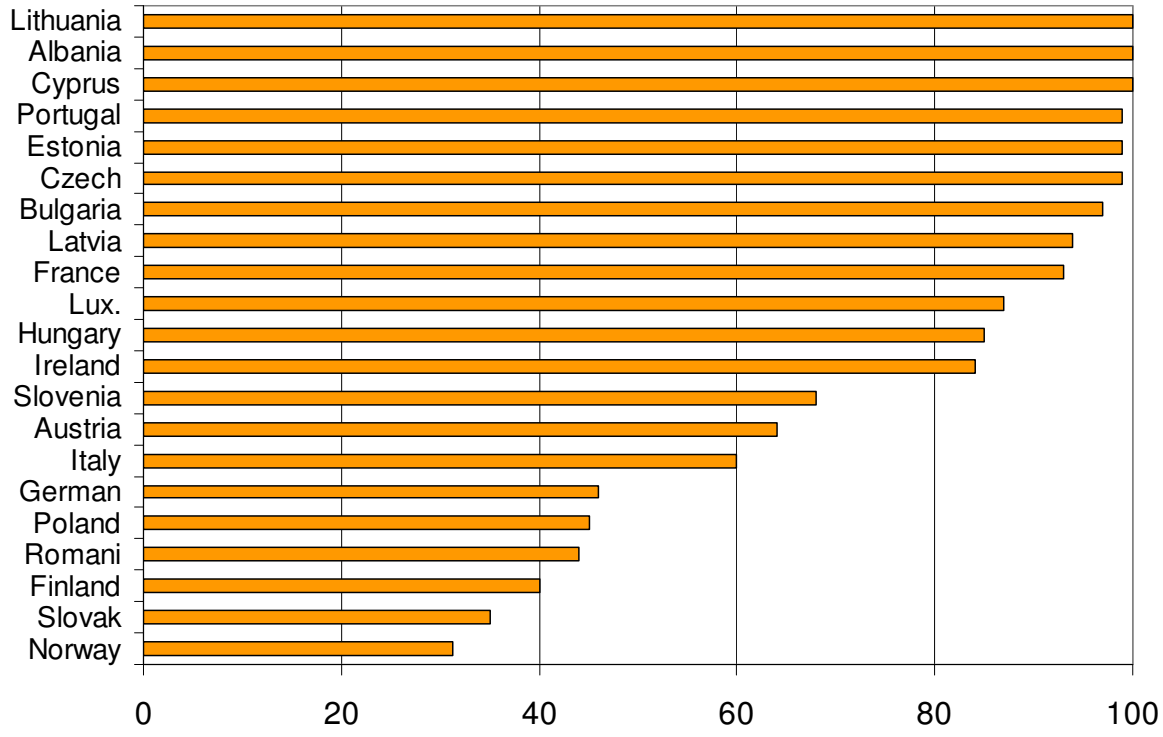
Table 4: Congestion on international electricity interconnectors

Hours with congestion as a percentage of all hours (selection of borders)		
Border	**2004** Jan-May	**2005** Jan-May
SK --> HU	100,0	100,0
FR --> CH	100,0	100,0
DE --> DK	99,3	100,0
NL --> BE	96,4	100,0
FR --> UK	94,6	95,6
DE --> NL (1)	87,9	90,1
FR --> ES	34,6	81,1
CZ --> DE	69,2	68,0
NL --> DE (1)	62,9	63,9
BE --> NL	63,3	63,1
DE --> FR (1)	0,0	41,3
CZ --> AT	0,0	37,0
DE --> CZ (1)	30,0	35,7
UK --> FR	31,5	35,0
FR --> DE	48,4	33,3
ES --> FR (1)	30,0	32,8
PL --> SK	0,0	19,1
ES --> PR	7,8	17,5
PL --> CZ	15,8	16,1
PR --> ES	26,7	11,7
FR --> BE	30,4	11,0
CZ --> PL	0,2	10,1
SK --> CZ	1,4	6,6
CZ --> SK	2,1	1,1
DE --> CH (1)	0,0	1,0
FR --> IT	0,7	0,8
AT --> CZ	0,0	0,3
CH --> FR	0,0	0,0
IT --> FR	0,0	0,0
BE --> FR	0,0	0,0
DE --> AT	0,0	0,0

Source: Energy Sector Inquiry 2005/2006.
Note: Hours when requested capacity exceeded available cross border capacity as a percentage of all hours. The arrows indicate the direction per border, in some cases reported by different TSOs.
(1) Refers to an average of more than one interconnector between two adjacent borders.

Source: European Commission (2007, Part 2, p.173).

Figure 6: Market Share – Three largest Retailers (2008)



Source: ERGEG data

Table 5: 2007 switching rates in different countries (%)

Country	In large industry	In medium-sized industry	In small industry and households	In the whole retail market
Austria	7.3	2.1	1.5	
Bulgaria	48.6	1.1	0	12.7
Cyprus	0	0	0	0
Czech Rep.	6	3	0.1	0.8
Denmark		20.8	6.4	13.7
Estonia	0	0	0	0
Germany	13.2	9.7	4.2	10
Greece	0	0	0	0
Italy	1.2	7	4	4.6
Latvia	0	2	0	1
Lithuania	0	0	0	0
Luxembourg	29.1	0.4	0.2	15
Poland	17	0.1	0	7.8
Portugal		14.1	5.2	7.2
Romania	6.2	7.1	0.9	
Slovakia		0	0	2
Slovenia	0	6.5	4.5	3.6
Spain	10	22	3	10
Sweden	8.7	8.7	10.4	9.1
Source: ERGEG data, 2008				

Section 5: Sector Performance

We begin our look at the performance of the electricity sector under liberalisation with an examination of performance at the EU and national levels. We need to start by defining what a good performance at the sector level might look like. We suggest that a good performance at the sector level would in general involve the following elements: falling prices, price convergence, improved use of available capacity, increased labour productivity, a more diversified resource base and no deterioration in security of supply.

A fall in average electricity prices excluding taxes across the EU, *relative to an appropriate counterfactual,* would indicate that liberalisation was delivering generally lower prices as a result of greater efficiencies and competition. This would also involve convergence in prices towards the average as a result of efficient trading. There might be some rebalancing of individual prices to better reflect underlying relative costs as implicit cross-subsidies are eliminated (e.g. between commercial and industrial customers). Tariffs would be expected to become more response to fluctuations in underlying commodity prices (i.e. more volatile). More efficient use should be made of reserve capacity, leading to a fall in reserve margins. These trends would affect the wholesale and retail components of electricity prices. Regulated network tariffs should fall in real terms as independent regulation leads to tougher price controls. These measures focus attention on more efficient pricing, costs and use of capacity. A healthy EU wide market might also be characterised by a more diversified resource base as gas replaces coal (stimulated by new entry) and more renewables are added to the system (as a result of renewable support mechanisms). Finally, in contrast to the fears raised during the blackouts of 2003, we would want the electricity system to exhibit no significant increase in the risk of blackouts following electricity liberalisation.

Some evidence on the above is given below.

5.1: Changes in price levels and price dispersion

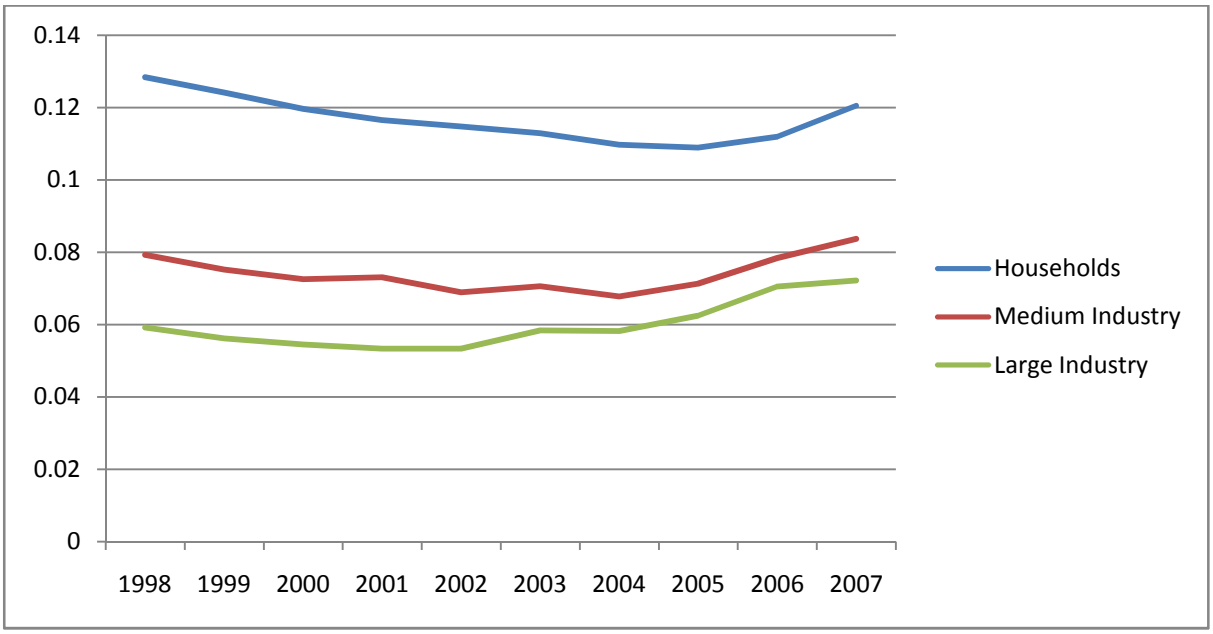
Figure 7 shows that EU average prices (excluding taxes) did fall in real terms for each of three major consumer groups, at least until 2003. It is hard to tell if this is a good performance in the absence of a counterfactual which takes account of fluctuations in underlying commodity prices for coal and gas. Some evidence that there was initially some price benefit from liberalisation is given in Figure 8 which shows US vs EU electricity prices. It does appear that residential and industrial customers in the EU were doing relatively better than those in the US between 1999 and 2005, but less well since then. However the US dollar has depreciated significantly against the Euro over the period and this may be masking the improvements in the EU.

Figure 9 suggests that there has been some price convergence across EU countries (excluding taxes), especially for large industrial customers. This trend is particularly marked between 1998 and 2003 when the variation significantly for both residential and industrial customers. Interestingly the degree of convergence between residential and industrial customers has become more similar. Overall the picture is one of convergence where prices have been free to converge. This suggests that where competition has been effective there has been an increase in convergence, but that this is by no means widespread. This picture of price convergence in electricity prices compares very

favourably to general price level convergence trends across the EU-15, where there was almost no price convergence over the 1997-2004 period.[3]

Figure 10 looks at the variation in national prices in more detail. It shows that there continues to be significant divergence in network charges between countries (compare Hungary and Poland) and in taxes and levies on electricity (compare Denmark and Czech Republic). While there is some evidence that linked markets have similar wholesale electricity prices (e.g. Denmark and Germany). Clearly there is some way to go before all of the elements that make up final prices in national markets converge to levels that could reasonably be explained by small underlying differences in efficient costs.

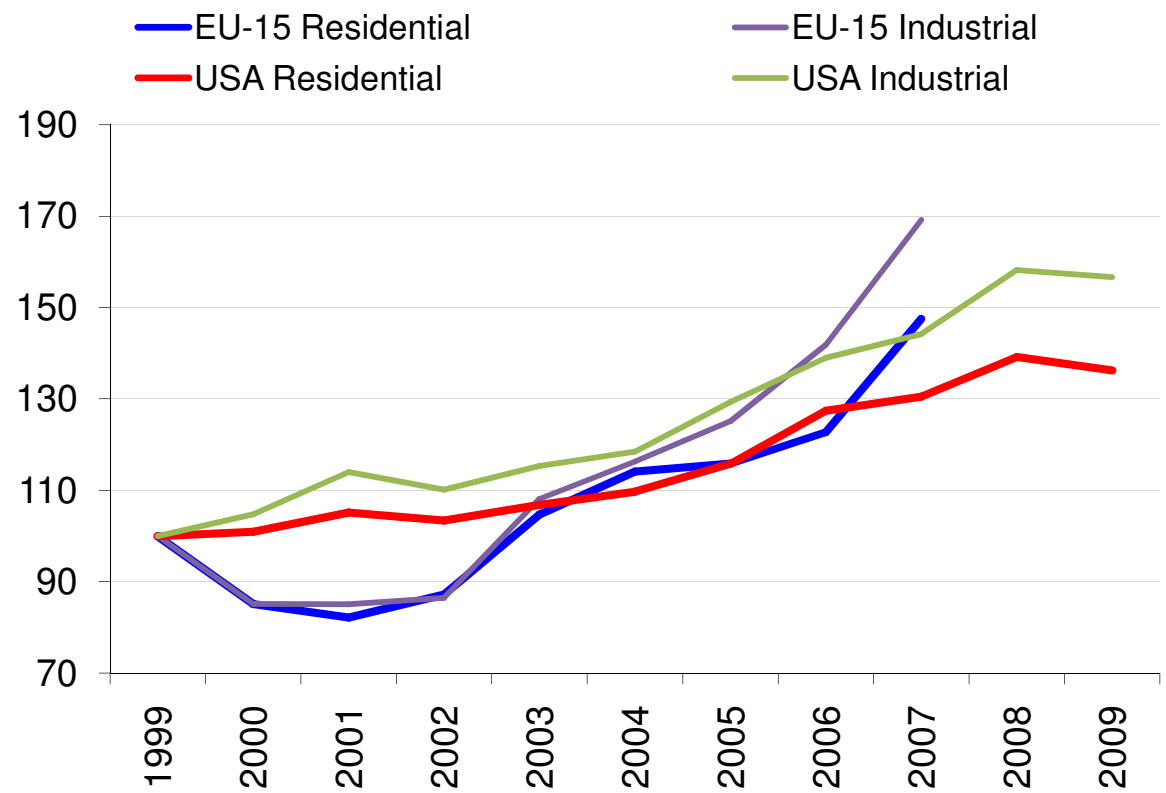
Figure 7: EU-15 Final Electricity Prices per KWh (2007 Euros)



Source: Eurostat.

[3] See http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsier020&language=en Accessed December 14th, 2009.

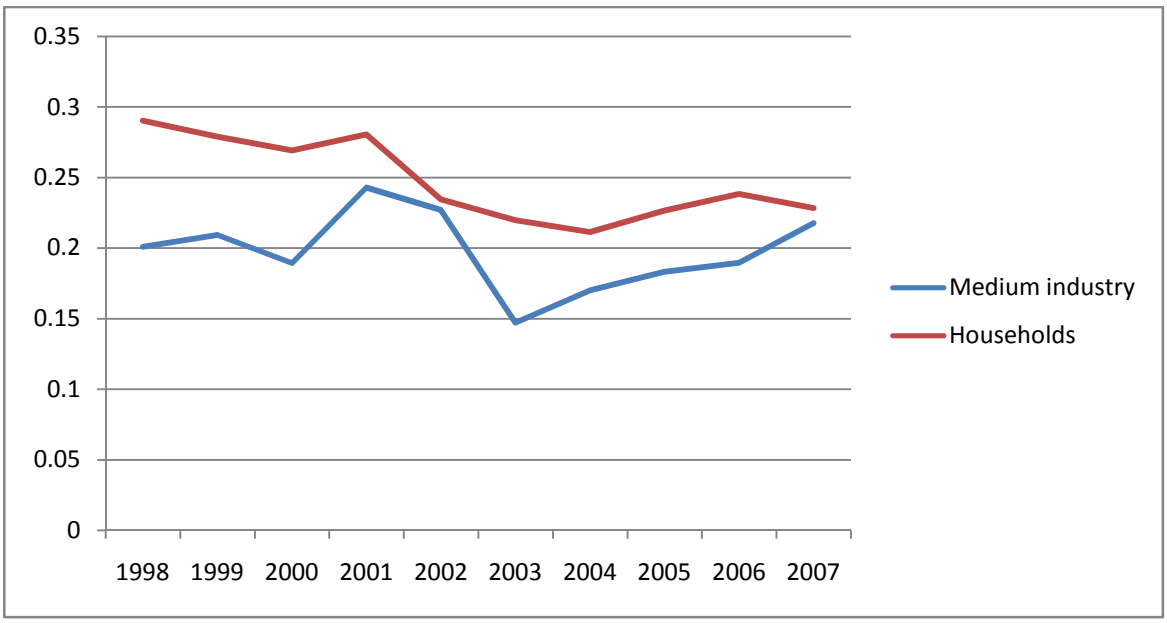
Figure 8: US vs EU Electricity Final Prices excluding taxes adjusting for exchange rate (1999 = 100)



Source: IEA, Eurostat

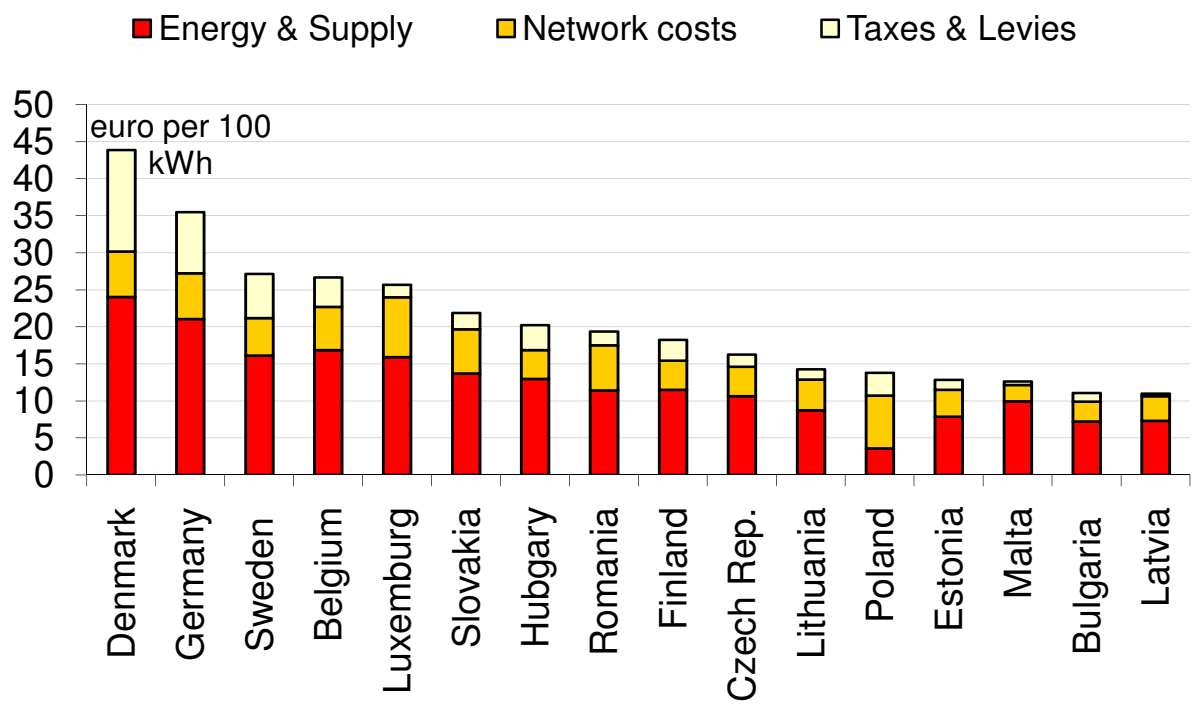
Figure 9: EU-15 Price Convergence in national average prices excluding taxes

(Annual coefficient of variation)



Source: Eurostat.

Figure 10: Estimated electricity price breakdown excluding taxes (2008)



Source: EC Benchmarking Report (2009).

5.2: Effects on capacity utilisation

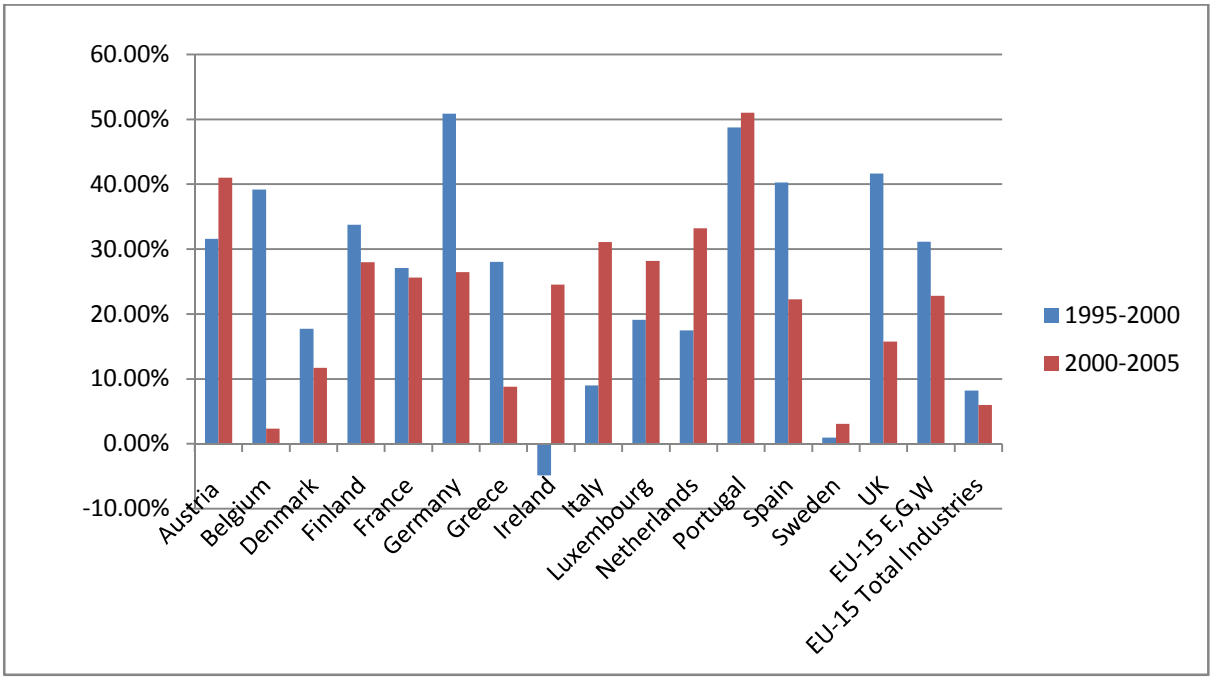
On the efficient utilisation of available generation capacity, it is now difficult to get a consistent measure of this across the EU, due to the increase in intermittent renewable generation capacity. This renders conventional measures of peak demand relative to maximum available capacity an unreliable measure of the true state of supply and demand balance within national markets (because maximum available capacity is conditional on weather conditions which are not necessarily co-incident with demand peaks). The figures for peak demand and maximum available capacity, seem to suggest that on the face of it the supply and demand balance has improved between the EU 3rd Benchmarking Report (2004) which reported figures for 2003 and the latest figures for 2007 (EU Benchmarking Report, 2009, Technical Annex, p.43).

5.3: Labour productivity effects

Figures 11 and 12 give the evidence on labour productivity improvements in the electricity sector. Figure 11 gives the more general context. While the average labour productivity improvement for all industrial sectors was around 5% for both five year periods 1995-2000 and 2000-2005 across the EU-15, in the electricity, gas and water subsectors, the improvement was more than 20% for each five year period. This performance was mirrored across most of the individual countries, with some variation as to the timing of the delivery of efficiency gains depending on the starting point for reforms. Thus early reformers, like the UK, show relatively better performance in the first five year period. By contrast later reformers, such as Ireland, show relatively better performance for the second five year period. Electricity liberalisation has clearly had a significant effect in the area of sector level efficiency. Figure 12 confirms that, for the countries for which comparable data is

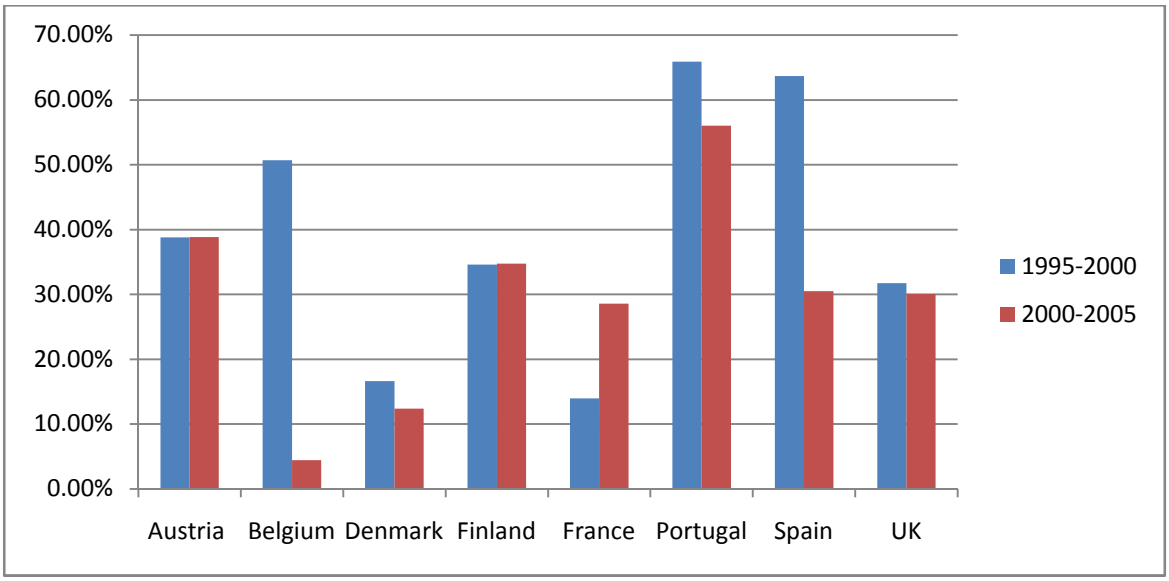
available, the figures for electricity, gas and water are representative of the effects at the electricity only level.

Figure 11: Labour productivity in electricity, gas and water 1995-2005



Source: EU KLEMS database: Output per hour worked (LP_I).

Figure 12: Labour productivity in electricity supply 1995-2005



Source: EU KLEMS database: Output per hour worked (LP_I).

5.4: Impact on diversity of generation sources

Table 6 shows the trend in the diversity of electricity generation resources since 1994. There has been a reduction in the degree of concentration of generation by type, mainly as a result of rising renewables and gas generation. This is in line with predictions as to the impact of EU policies, though the effect is somewhat masked by the transition from EU-15+Norway to EU-27+Norway between 2004 and 2006.

Table 6: Market shares and Herfindahl index for generation sources in EU-15+Norway

	1990	1994	1998	2002	2006*
Coal	37.1	32.0	27.9	26.2	28.6
Oil	9.0	8.4	7.8	5.6	3.9
Gas	6.9	9.5	14.7	17.3	21.1
Biomass	0.3	0.6	0.8	0.9	2.7
Waste	0.4	0.5	0.8	0.9	n.d.
Nuclear	33.4	34.9	34.2	31.2	29.5
Hydro	12.8	13.8	13.1	16.6	9.2
Geothermal	0.1	0.2	0.2	0.2	0.2
Solar PV	0.0	0.0	0.0	0.0	0.7**
Solar thermal	0.0	0.0	0.0	0.0	
Other sources	0.1	0.2	0.5	1.0	1.1
HHI	2781	2589	2339	2271	2242

* EU-27 + Norway

** Includes solar thermal generation

Source: IEA and Eurostat data

5.5: Impact on security of supply

Yu and Pollitt (2009) discuss the evidence on the impact of electricity liberalisation on the incidence of newspaper reported blackouts in Europe. They find that for the period 1998-2007 there is no evidence of a statistically significant increase in the number of newspaper reported blackouts correlated with the degree of liberalisation. They do however suggest that there is limited evidence that the risk of large multi-country blackouts has increased as a result of increased cross-border trade in electricity. However blackout probabilities remain low and responsive to better international co-ordination (Bailek, 2004).

Overall, the picture is of mixed progress at the sectoral level towards the desired effects of electricity liberalisation at the EU and national level.

Section 6: Firm level performance

Next we examine the performance of the electricity sector under liberalisation from the perspective of firm performance. When it comes to firm performance we are considering good performance in the context of what might be best for society. Thus we might say that a good performance for society at the level of the firm would involve the following: a more competitive market structure;

increased merger activity to exploit efficiency gains; and levels of profitability consistent with supporting required investments. We have already observed the very significant improvements in labour productivity at the national sector level (and by implication at the level of the sector's constituent firms).

6.1: Market shares

Assessing trends in market structure at the level of the EU is difficult due to a lack of reporting of data. Jamasb and Pollitt (2005) reported evidence of significant market share increases in generation by RWE, E.ON and Vattenfall in the period 1998-2002. If anything market shares, at the whole EU, level in generation have consolidated since then due to the take-overs of National Power, Scottish Power and Electrabel. This may not of itself be an issue for likely firm performance if the offsetting efficiency savings and increased trans-European rivalry results in lower costs and lower prices.

Looking at competition in supply the picture is even less clear. EdF, ENEL, E.ON and RWE report 38m, 32m, 22m and 14m electricity customers in their latest annual reports. If the total number of EU electricity customers is around 250m (a rough estimate) this suggests that around 40% of EU electricity customers are served by 4 companies. This would not be problem if each of the four firms was equally present in all markets. If this were the case it would represent a significantly liberalised retail electricity market. However each of the top four companies remains heavily concentrated on its home market (France, Italy, Germany and Germany respectively) resulting in the high market shares in individual national markets noted earlier.

6.2: Merger activity

Figure 13 shows the pattern of merger activity in the EU electricity sector between 2000 and 2009. This shows that there has been very significant merger activity, as might be predicted following liberalisation. The highlighted boxes show mergers which have the result of increasing vertical integration, either within the electricity sector or by electricity companies acquiring gas company assets. Vertical mergers have the result of reversing the unbundling intentions of the EU electricity directives (even though they may be cross-border or cause bundling which did not previously exist). As such they may create significant barriers to unbundled new entrants such as stand-alone generation companies or retailers. Clearly the merger activity in the sector is very significant and requires closer monitoring by competition authorities, especially as the number of remaining companies declines.

6.3: Firm profitability

An examination of the performance of an index of European electricity stocks against an index of general stocks (over the period January 1992-June 2009) addresses the issue of the financial performance of the electricity sector over the liberalisation period[4]. The evidence suggests that while electricity stocks did underperform during the early period of liberalisation (1996-2000) as the EU electricity directives were transposed into national legislation, there is no evidence of underperformance in the most recent period. Electricity stocks, if anything, finish the period ahead of the all stocks index. This suggests that the financial performance of the industry has not been unduly impacted by reform, and there is no suggestion of a fundamental financing problem with the sector.

[4] See http://www.stoxx.com/indices/benchmarking.html.

Figure 13: Electricity Sector: M&A deals by type of purchaser and acquired company

Acquired company	Generation	Distribution	Gen + distr or gen + sales company	Integrated company or gen + distr + sales company
Company active (also) in the gas sector	19	11	10	116
Integrated company or gen + distr + sales company	12	0	3	84
Gen + distr or gen + sales company	0	0	1	2
Distribution	0	20	2	31
Generation	45	0	18	183

Purchaser

Source: elaborations on M&A Database, REF Ricerche per l'Economia e la Finanza

6.4: Econometric evidence on reform effects

Sections 5 and 6 present the raw data evidence on sector and firm level performance under liberalisation. Econometric evidence, over earlier sample periods, confirms the general trends we identify with respect to wholesale and final prices and costs. Thus Steiner (2001), Hattori and Tsutsui (2005) and Fiorio et al. (2007) find evidence of productivity improvements. These papers also find weak evidence on price benefits. de Silva and Soares (2008) present evidence of wholesale price convergence across national markets. However these country level studies suffer from the inability to satisfactorily measure reforms as a package, largely falling back on adding up or separating out individual reform elements (e.g. privatisation or vertical unbundling).

Other evidence, such as Copenhagen Economics (2005), shows stronger performance in leading reform countries (such as the UK and Norway) at both the micro-economic and at the whole economy level. As noted earlier, comparison of reform elements reveals that in contrast to the leading reform sector, telecoms, there is some way to go in electricity reform implementation in many EU countries (Wolfl et al., 2009).

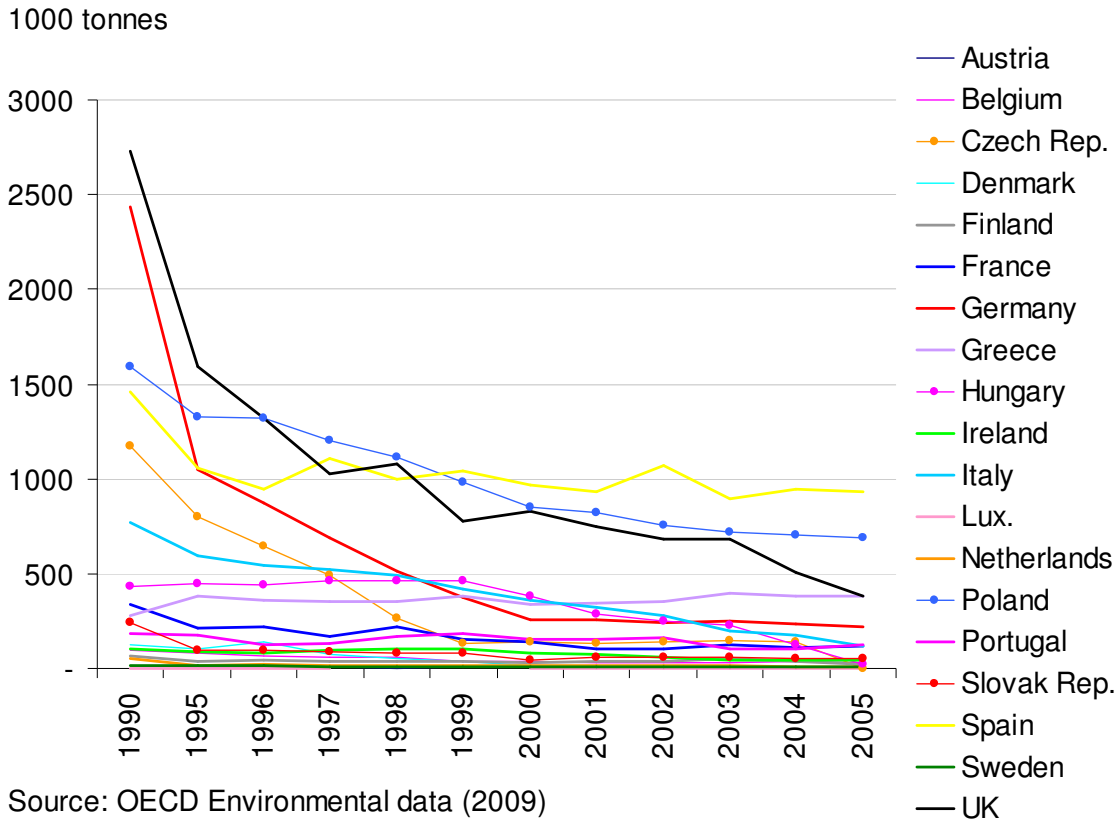
Section 7: Progress in reducing emissions and promoting renewables

An increasingly important part of EU electricity policy focuses on the environmental effects of the sector. This policy is expensive and is beginning to impact on overall costs and prices. However it is beginning to show significant performance effects. The policy began with a focus on mitigating the national and regional pollutants such as sulphur oxides and nitrous oxides (SOx and NOx), before moving on to Greenhouse Gases (such as CO2). In parallel the EU has developed targets for renewable energy with the aim of increasing renewable electricity generation. These 20-20 targets in 2020, essentially target a 20% reduction in CO2 on 1990 levels by 2020 and a renewable energy share in total energy consumption of 20% by 2020. These targets imply even more substantial CO2 reduction targets and renewable generation share targets from the electricity sector given the relative ease with which progress towards the targets can be achieved in the electricity sector as opposed to transport and heat sectors to 2020.

Figures 14 and 15 show that there has been a significant degree of progress on SOx and NOx reductions for the 19 countries listed. Overall SOx emissions from power stations fell 74% and NOx emissions fell 44% between 1990 and 2005. Figure 16 shows that, on CO2, progress has been less impressive with a total fall of only 3% between 1990-2006 for the 19 countries listed. This can be attributed to the failure of the EU emissions trading system for CO2 to restrict CO2 quantities and hence give high enough CO2 prices to incentivise decarbonising the electricity sector.

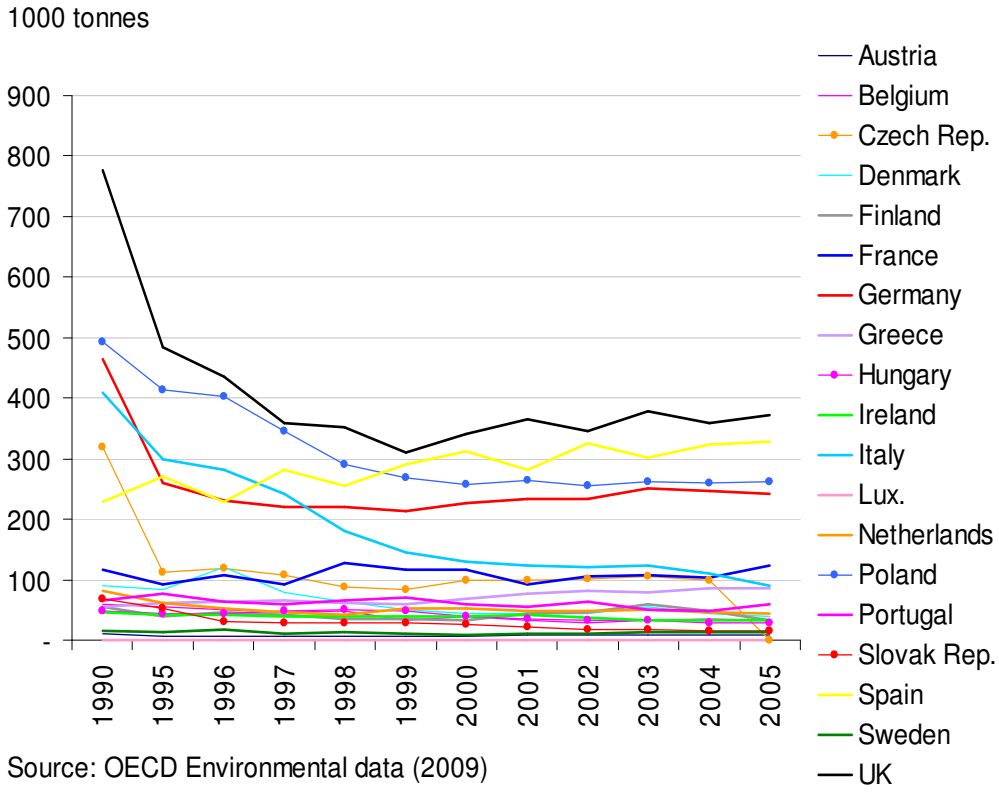
On renewables, overall progress has been slow, in part due to the declining share of large scale hydro in the overall electricity mix. For the EU-15+Norway+Switzerland the rising share of renewables such as wind has just managed to replace declines in hydro, as shown in Table 7. Figure 17 shows progress towards the EU's 2010 national targets for renewable electricity (under Directive 2001/77/EC). Progress by 2006 was significantly behind target in major EU countries, with only Germany, looking like it might meet its target. National targets for 2020 are framed in terms of renewable energy (rather than just electricity), as illustrated in Table 8 (under Directive 2009/28/EC). These targets seem just as likely to be missed with the largest EU countries – Germany, France, Italy, UK and Spain – all having gaps of more than 10% between their 2006 share of renewable energy and their 2020 targets.

Figure 14: Power sector SOx emissions



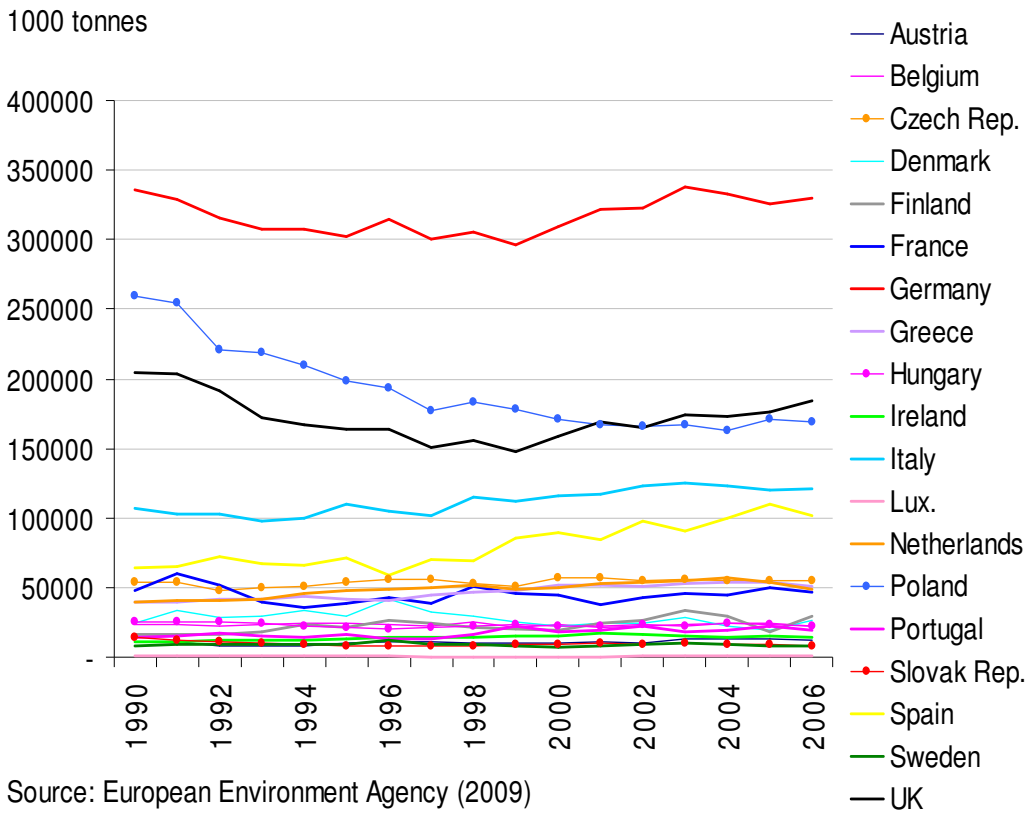
Source: OECD Environmental data (2009)

Figure 15: Power sector NOx emissions



Source: OECD Environmental data (2009)

Figure 16: Power sector CO2 emissions



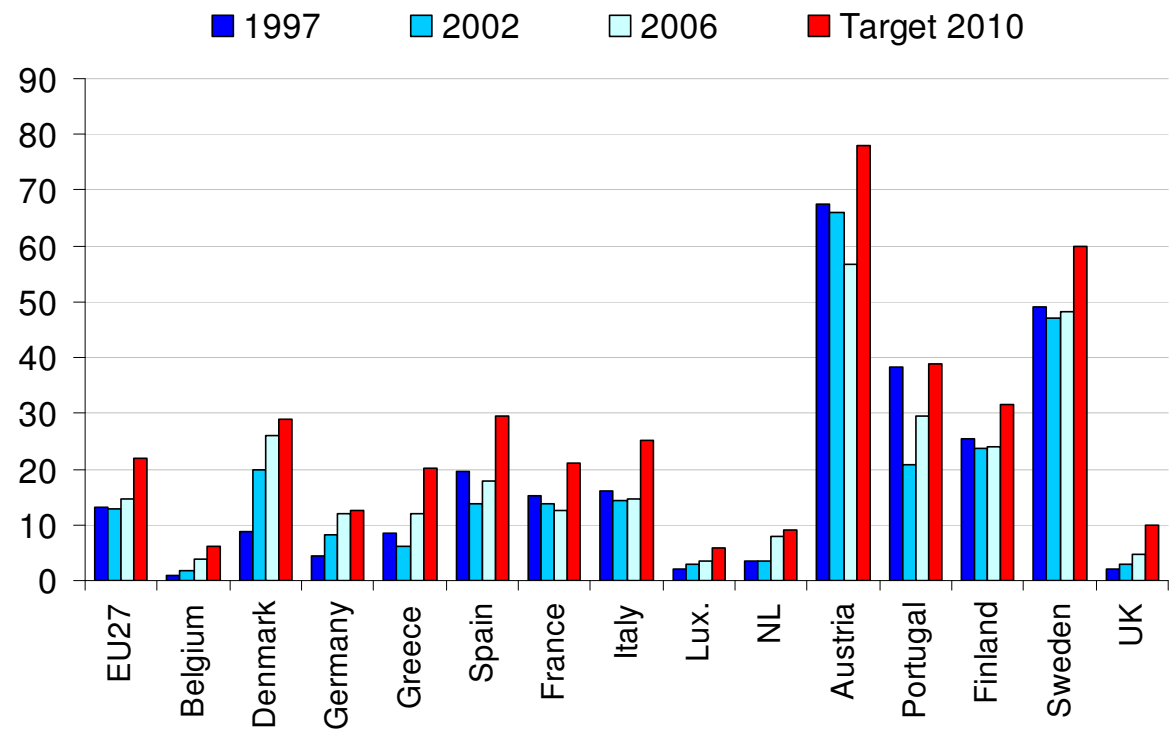
Source: European Environment Agency (2009)

Table 7: Renewable electricity share (%) of electricity generation EU-15+Norway+Switzerland

	1974	1980	1990	1995	2000	2001	2002	2006
RES Share	24.40	22.31	18.23	18.91	19.70	19.71	18.02	19.91
Hydro Share	23.97	21.84	17.72	17.97	17.80	17.61	15.52	13.99
Solar, Wind, Tide Share	0.04	0.03	0.06	0.20	0.86	1.02	1.35	5.65
Geothermal Share	0.17	0.15	0.14	0.14	0.17	0.16	0.17	0.27
Other Renewables	0.22	0.30	0.32	0.60	0.86	0.92	1.00	n.d.

Source: DG TREN, 2009, and IEA Electricity Balances 2003

Figure 17: 2010 targets for renewable electricity generation relative to progress



Source: DG TREN (2009)

Table 8: Renewable Energy Targets for 2020

	2020	2006
Belgium	13%	3%
Bulgaria	16%	9%
Czech Rep.	13%	6%
Denmark	30%	17%
Germany	18%	8%
Estonia	25%	17%
Ireland	16%	3%
Greece	18%	7%
Spain	20%	9%
France	23%	10%
Italy	17%	6%
Cyprus	13%	3%
Latvia	40%	31%
Lithuania	23%	15%
Luxembourg	11%	1%
Hungary	13%	5%
Malta	10%	
Netherlands	14%	3%
Austria	34%	25%
Poland	15%	8%
Portugal	31%	22%
Romania	24%	17%
Slovenia	25%	16%
Slovak Rep.	14%	7%
Finland	38%	29%
Sweden	49%	41%
UK	15%	2%
Source: DG TREN, 2009		

The EU's policies on decarbonisation and on renewables seem likely to have serious implications for liberalisation of wholesale and retail electricity markets. If decarbonisation leads to more nuclear power or the widespread use of carbon capture and storage plants this will imply increased financial barriers to entry and reduced flexibility in the operation of large scale generation. This will strengthen the power of incumbent generators and possibly lead to further consolidation in wholesale and by implication retail electricity markets.

An increased share of renewables in the generation mix will lead to higher volatility in electricity supply and marginal prices. In parts of Northern Europe, wind output volatility already poses a significant grid management challenge. It will also create significant financing challenges for both renewable and conventional generators who may receive unreliable signals for investment from the short run balancing market. Further integration of the EU market as a whole will certainly help manage these problems in aggregate but may not be enough to forestall increasingly large interventions in the market to support the financing of capital intensive low carbon investment projects.

Section 8: Recent developments in EU electricity reform

Two recent developments indicate both the state of electricity reform to date and some likely directions that it might take in the future. The EU Energy Sector Inquiry (begun in 2005) was completed in January 2007 by DG Competition (European Commission, 2007). This confirmed that there were 'serious competition problems' with the EU electricity market. The Inquiry concluded that there was a basis for further action and that the Commission intended to pay serious attention to future merger proposals (particularly those involving electricity and gas assets) and to state aids to the sector. There was also a commitment to vigilance on the possibility of collusion between the major European electricity companies. The Commission concluded that vertical integration between generation/supply businesses and network businesses was a problem and hence that ownership unbundling of transmission assets was desirable. There was an issue of access to the transmission grid, particularly cross border where electricity and gas did not always flow in the direction suggested by market price differentials even when capacity was available.

In the light of the Energy Sector Inquiry, DG TREN proposed a third legislative package on electricity and gas market reform in September 2007. This strengthened the legislative support for unbundling by recommending ownership unbundling of transmission assets, with an independent system operator model (ISO) with continuing transmission wire asset integration as an alternative. Asset sales to parties outside the EU would be restricted to those countries with similar unbundling requirements (this would restrict Russian purchases of EU electricity and gas assets). A European wide regulatory agency would be established, with binding decision making powers, to complement national energy regulators. There would be requirements for increased independence of national regulators. A new European network for transmission system operators would be established and there would be greater transparency towards network operation and supply.

The requirement for ownership unbundling of transmission met with the most national opposition. France and Germany proposed an economically efficient unbundling (EEU) option. This would involve a legally separate TSO within an integrated group, a compliance officer to ensure operational separation of the transmission business and restrictions on movement of staff between business units. This has been included in the final Directive 2009/72/EC.

However in the meantime, the EU Energy Sector Inquiry, prompted voluntary proposals to sell off transmission assets (as of October, 2009): E.ON have offered to sell their electricity TSO and some 4.8 GW of generation capacity. Vattenfall have offered to sell their electricity TSO. RWE have offered to sell their gas TSO, but not their electricity TSO. These proposed sell-offs have been postponed by the credit crunch but represent attempts by the companies to reduce the risk of future competition authority action. They fall some way short of ensuring full ownership unbundling in the main central European regional market, but they will provide important evidence going forward on the impact of unbundling (particularly on costs, entry and security of supply, all of which it was initially suggested would worsen if forced unbundling occurred).

Both of these developments suggest that further progress is likely as a result of European Commission action in pushing nation states towards a more competitive electricity market.

Section 9: Conclusions

It is difficult to briefly summarise the result of a simultaneous economic policy experiment carried out across 27 countries. While some European countries have made substantial progress towards competitive electricity markets (e.g. the UK, Sweden and Finland), others have some way to go (e.g. France and Germany). However there are a number of general conclusions that may usefully be drawn at this stage.

First, there has been an impressive forcing effect of successive EU electricity directives. Market opening has proceeded rapidly across the EU. There has been a standardisation of market rules and regulation and widespread acceptance of what constitutes best practice.

Second, there have been some notable market impacts. These include significantly increased EU cross-border trade in electricity, improvements in the quality of regulation, impressive labour productivity gains, some price falls (relative to the counterfactual) and a degree of price convergence.

Third, the market remains incomplete and significant competitive concerns have been identified by the European Commission. Prices have risen and diverged since 2003 and there seems to be continuing market power being exercised by incumbents and concerns that mergers may be increasing this.

Fourth, a positive social cost benefit analysis of reforms at the EU level is still difficult to call. Consumers were seeing lower prices and convergence but this trend has been partially reversed. Profits of EU electricity firms have not suffered unduly due to the introduction of competition. The impact on government in terms of increased government efficiency, reduced subsidy and improved tax revenue is not clear, but there is no clear evidence that governments have suffered welfare losses due to electricity reforms.

Fifth, significant new challenges to the liberalisation agenda have emerged. These include concerns about security of supply both as a result of rising quantities of intermittent renewables on the system and also about the reliability of Russian gas deliveries to the EU (following Russia's gas disputes with Ukraine) and hence whether 'energy security' should be left to the market. They also arise from an ambitious EU climate change policy and its requirement to move towards rapid decarbonisation of the electricity sector. This has raised issues of whether national support

mechanisms for low carbon generation can be made to mesh with a competitive wholesale electricity market.

Finally, high commodity prices and the rising costs of renewables have raised issues of energy poverty and the extent to which governments need to intervene in the pricing of residential electricity to protect poor consumers.

What might the next five years of EU electricity market development bring? Will liberalisation continue to advance or will it go into reverse?

On the side of advancement, there has already been significant progress with reform and significant supportive action via the Energy Sector Inquiry and the Third Legislative Package. The Single Market remains a powerful intellectual and political imperative for the EU, from which it would seem difficult to extract electricity markets. Indeed many of the future challenges facing the EU on climate change and renewable can only be sensibly addressed in the long run with a functioning EU wide electricity (and emissions) market.

On the other hand, progress with (and support for) electricity reform is limited in many EU countries and the evidence of obvious gains weak. It is also clear that liberalised electricity markets face significant climate and renewables targets and that energy security is a growing issue. In these circumstances the capacity for accidental or intentional ending of progress towards a fully functional EU wide wholesale and retail market would seem to be high.

What is certain is that at the national level there will be scope for significant divergences of policy on electricity liberalisation, even within a generally supportive EU framework. As is already the case, policy divergence will largely be driven by national levels of commitment to competitive energy markets (and indeed to competition more widely).

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